IN THE CLAIMS

Please amend Claims 1, 3, 26, 35, 36, 45, 47, 51, and 54. The claim amendments are submitted in "revised amendment format" as described in *AMENDMENTS IN A REVISED FORMAT NOW PERMITTED*, signed January 31, 2003, and published in *Official Gazette* on February 25, 2003.

CLAIM AMENDMENTS

1. (Currently Amended) A software-based, flexible computer architecture for
communication and cooperation among distributed electronic agents, the
architecture contemplating a distributed computing system comprising:

a plurality of service-providing electronic agents;

a distributed facilitator agent functionally distributed across at least two
computer processes, the facilitator agent capable of bi-directional
communications with the plurality of service-providing electronic
agents, the facilitator agent including:

an agent registry that declares capabilities for each of the plurality of
service-providing electronic agents currently active within the
distributed computing environment; and

a facilitating engine operable to interpret a service request as a base
goal,

the facilitating engine further ~~coordinate~~ operable for generating a goal
satisfaction plan associated with the base goal, wherein the
goal satisfaction plan includes:

a suitable delegation of sub-goal requests to best complete the
requested service request~~.~~ by using reasoning that
includes one or more of domain-independent
coordination strategies, domain-specific reasoning, and
application-specific reasoning comprising rules and
learning algorithms.

2.   A software-based, flexible computer architecture as recited in claim 1 wherein
the distributed facilitator agent includes a plurality of single process facilitator
agents each executing within a separate computer process, each of the
single process facilitator agents being bi-directionally coupled with at least
one other single process facilitator agent.

3. (Currently Amended) A software-based, flexible computer architecture as recited in claim 2 wherein each single process facilitator agent has, any necessary facilitating functionality, a specific single process facilitator including:

a specific agent registry that declares capabilities for each of the plurality of service-providing electronic agents currently active within the process wherein the specific single process is executing, the specific agent registry further declaring capabilities made available to the specific single process facilitator agent through the at least one other single process facilitator agent bi-directionally coupled with the specific single process facilitator agent; and

a specific facilitating engine operable to interpret a service request as a base goal, the facilitating engine further operable to determine sub goals required to complete the base goal; the facilitator engine further operable to select service providing agents best capable of ~~compling~~ completing the sub goal and assigning the sub goals thereto.

4. A software-based, flexible computer architecture as recited in claim 3 wherein at least two of the plurality of single process facilitator agents reside upon separate computer systems.

5. A computer architecture as recited in claim 4, wherein the basis for the computer architect is an Interagent Communication Language (ICL) enabling agents to perform queries of other agents, exchange information with other agents, and set triggers within other agents, the ICL further defined by an ICL syntax supporting compound goal expressions such that goals within a single request provided according to the ICL syntax may be coupled by a conjunctive operator, a disjunctive operator, a conditional execution operator, and a parallel disjunctive operator that indicates that disjunctive goals are to be performed by different agents.

6. A computer architecture as recited in claim 5, wherein the ICL is computer platform independent.

7. A computer architecture as recited in claim 6 wherein the ICL is independent of computer programming languages in which the plurality of agents are programmed.

8. A computer architecture as recited in claim 7 wherein the ICL syntax supports explicit task completion constraints within goal expressions.

9. A computer architecture as recited in claim 8 wherein possible types of task completion constraints include use of specific agent constraints and response time constraints.

10. A computer architecture as recited in claim 8 wherein the ICL syntax supports explicit task completion advisory suggestions within goal expressions.

11. A computer architecture as recited in claim 5 wherein the ICL syntax supports explicit task completion advisory suggestions within goal expressions.

12. A computer architecture as recited in claim 5 wherein each autonomous service-providing electronic agent defines and publishes a set of capability declarations or solvables, expressed in ICL, that describes services provided by such electronic agent.

13. A computer architecture as recited in claim 12 wherein an electronic agent's solvables define an interface for the electronic agent.

14. A computer architecture as recited in claim 1 wherein the distributed facilitator agent is formed in a hierarchical topology.

15. A computer architecture as recited in claim 14 wherein the hierarchical topology includes a top level facilitator agent and at least one other facilitator agent registered within the top level facilitator agent, the top level facilitator agent operable to directly manage those service-providing agents registered within the top level facilitator agent and indirectly manage those service-

providing agents registered within the at least one other agent registered with the top level facilitator agent.

16. A computer architecture as recited in claim 15 wherein the top level facilitator agent and the at least one other facilitator agent are executing on different computer systems.

17. A computer architecture as recited in claim 15 wherein the at least one other facilitator agent is installed for a specific computer user.

18. A computer architecture as recited in claim 15 wherein the at least one other facilitator agent is installed for a specific group of users.

19. A computer architecture as recited in claim 15 wherein the at least one other facilitator agent is installed for a specific computer application.

20. A computer architecture as recited in claim 1 wherein the distributed facilitator agent includes a planning component executing within a first computer process and an execution component executing within a second computer process.

21. A computer architecture as recited in claim 20 wherein the planning component is one of a plurality of synchronized planning components each executing with separate computer processes, whereby the computer architecture provides a more robust operating environment due to redundancy of the planning component functionality of the distributed facilitator agent.

22. A software-based flexible computer architecture for communication and cooperation among distributed electronic agents, the architecture contemplating a distributed computing system comprising:
    a plurality of service providing electronic agents;
    at least one facilitator agent capable of receiving a service requests in the
        form of a base goal from a client agent in an interagent communication

language and capable of determining sub goals necessary to accomplish the base goal, the facilitator operable to allocate each sub-goal to at least one server agent capable of accomplishing the sub-goal as determined by the registry; and

at least one agent capable of making a request directly to a server agent as a peer to peer communication for accomplishment of at least one of the sub-goals.

23. A software based, flexible computer system as recited in claim 22 wherein the peer to peer communication is in a language other than an interagent communication language.

24. A software based, flexible computer system as recited in claim 22 wherein the peer to peer communication is bi-directional.

25 A software based, flexible computer system as recited in claim 22 wherein the agent operable to make said peer to peer service request is said facilitator agent.

26. (Currently Amended) A distributed facilitator agent functionally distributed across at least two computer processes, the distributed facilitator agent arranged to coordinate cooperative task completion within a distributed computing environment having a plurality of autonomous service-providing electronic agents, the distributed facilitator agent comprising:

an agent registry that declares capabilities of service-providing electronic agents currently active within the distributed computing environment; and

a facilitating engine operable to parse a service request in order to interpret a compound goal set forth therein, the service request formed according to an Interagent Communication Language (ICL), the facilitating engine further operable to coordinate a suitable delegation of sub-goal requests to best complete the requested service by generating a goal

satisfaction plan associated with the compound goal, wherein the goal satisfaction plan includes:

using reasoning that includes one or more of domain-independent coordination strategies, domain-specific reasoning, and application-specific reasoning comprising rules and learning algorithms.

27. A facilitator agent as recited in claim 26, wherein the facilitating engine is capable of modifying the goal satisfaction plan during execution, the modifying initiated by events such as new agent declarations within the agent registry, decisions made by remote agents, and information provided to the facilitating engine by remote agents.

28. A facilitator agent as recited in claim 26 wherein the agent registry includes a symbolic name, a unique address, data declarations, trigger declarations, task declarations, and process characteristics for each active agent.

29. A facilitator agent as recited in claim 26 wherein the facilitating engine is operable to install a trigger mechanism requesting that a certain action be taken when a certain set of conditions are met.

30. A facilitator agent as recited in claim 29 wherein the trigger mechanism is a communication trigger that monitors communication events and performs the certain action when a certain communication event occurs.

31. A facilitator agent as recited in claim 29 wherein the trigger mechanism is a data trigger that monitors a state of a data repository and performs the certain action when a certain data state is obtained.

32. A facilitator agent as recited in claim 31 wherein the data repository is local to the facilitator agent.

33. A facilitator agent as recited in claim 26 wherein the data repository is remote from the facilitator agent.

34. A facilitator agent as recited in claim 29 wherein the trigger mechanism is a task trigger having a set of conditions.

35. (Currently Amended) A facilitator agent as recited in claim 26 A1, the facilitator agent further including a global database accessible to at least one of the service-providing electronic agents.

36. (Currently Amended) A facilitator agent as recited in claim 26 A1 wherein the distributed facilitator agent includes a plurality of single process facilitator agents each executing within a separate computer process, each of the single process facilitator agents being bi-directionally coupled with at least one other single process facilitator agent.

37. A facilitator agent as recited in claim 36 wherein each single process facilitator agent has any necessary facilitating functionality, a specific single process facilitator including:

a specific agent registry that declares capabilities for each of the plurality of service-providing electronic agents currently active within the process wherein the specific single process is executing, the specific agent registry further declaring capabilities made available to the specific single process facilitator agent through the at least one other single process facilitator agent bi-directionally coupled with the specific single process facilitator agent; and

a specific facilitating engine operable to parse a service request in order to interpret an arbitrarily complex goal set forth therein, the facilitating engine further operable to construct a goal satisfaction plan including the coordination of a suitable delegation of sub-goal requests to best complete the requested service.

38. A facilitator agent as recited in claim 37 wherein at least two of the plurality of single process facilitator agents reside upon separate computer systems.

39.   A facilitator agent as recited in claim 38 wherein the distributed facilitator agent is formed in a hierarchical topology.

40.   A facilitator agent as recited in claim 39 wherein the hierarchical topology includes a top level facilitator agent and at least one other facilitator agent registered within the top level facilitator agent, the top level facilitator agent operable to directly manage those service-providing agents registered within the top level facilitator agent and indirectly manage those service-providing agents registered within the at least one other agent registered with the top level facilitator agent.

41.   A facilitator agent as recited in claim 40 wherein the top level facilitator agent and the at least one other facilitator agent are executing on different computer systems.

42.   A facilitator agent as recited in claim 40 wherein the at least one other facilitator agent is installed for a specific computer user.

43.   A facilitator agent as recited in claim 40 wherein the at least one other facilitator agent is installed for a specific group of users.

44.   A facilitator agent as recited in claim 40 wherein the at least one other facilitator agent is installed for a specific computer application.

45. (Currently Amended) A facilitator agent as recited in claim 26 44 wherein the distributed facilitator agent includes a planning component executing within a first computer process and an execution component executing within a second computer process.

46.   A facilitator agent as recited in claim 45 wherein the planning component is one of a plurality of synchronized planning components each executing with separate computer processes, whereby the computer architecture provides a more robust operating environment due to redundancy of the planning component functionality of the distributed facilitator agent.

47. (Currently Amended) A facilitator agent for coordinating cooperative task completion within a distributed computing environment having a plurality of autonomous service-providing electronic agents, the distributed facilitator agent comprising

a registry of capabilities of the service providing agents; and

a facilitating engine operable to determine a set of sub goals necessary to accomplish the base goal, and then allocate such sub-goals to those agents capable of accomplishing the base goals as determined by the registry, said facilitator further capable of initiating a direct peer to peer communication of at least one sub-goal.

48. A facilitator as set forth in claim 47 wherein the peer to peer communication is in a language other than an interagent communication language.

49. A facilitator as set forth in claim 47 wherein the facilitator agent is functionally distributed across at least two electronic agents.

50. A facilitator as set forth in claim 49 wherein the peer to peer communication is between said distributed facilitator agents.

51. (Currently Amended) A computer-implemented method for providing cooperative task completion within a distributed computing environment, the distributed computing environment including a plurality of autonomous electronic agents, the distributed computing environment supporting an Interagent Communication Language, the computer-implemented method comprising the acts of:

providing a plurality of synchronized agent registries each declaring capabilities of service-providing electronic agents currently active within the distributed computing environment, the plurality of synchronized agent registries each resident within a separate computer process;

interpreting a service request in order to determine a base goal, the service
request adhering to an Interagent Communication Language (ICL), the
act of interpreting including the sub-acts of:
determining sub-goals required in completing the base goal;
determining a goal satisfaction plan that is associated with the base
goal;
wherein the goal satisfaction plan includes:
using reasoning that includes one or more of domain-
independent coordination strategies, domain-specific
reasoning, and application-specific reasoning comprising
rules and learning algorithms; and
~~selecting service-providing electronic agents from an available one of~~
~~the plurality of agent registries suitable for performing the~~
~~determined sub-goals, and~~
~~ordering a delegation of sub-goal requests to best complete the~~
~~requested service; and~~
implementing the base goal satisfaction plan.

52. A computer implemented process as recited in claim 51 wherein the step of
interpreting a service request is controlled by a computer process separate
from the computer processes wherein the plurality of synchronized agent
registries reside.

53. A computer implemented process for providing coordinated task completion
within a distributed computing environment, the distributed computing
environment including a plurality of autonomous electronic agents, the
computer implemented method comprising the steps of:
providing at least one agent registry including capabilities of service providing
electronic agents;
interpreting a service request in the form of a base goal, the service request
being in a interagent communication language;
determining a plurality of sub goals necessary to accomplish the base goal;

selecting from said registry at least one service providing agent capable of
completing said sub goals;

delegating at least one sub goal as a peer to peer service request directly
from a service requesting agent to a service providing agent; and

delegating any remaining sub goals as service request in the interagent
communication language to the selected agents capable of completing
the remaining sub-goals.

54. (Currently Amended) A computer-implemented method for providing cooperative
task completion within a distributed computing environment, the distributed
computing environment including a plurality of autonomous electronic agents,
the distributed computing environment supporting a dynamically expandable
Interagent Communication Language ("ICL"), the computer implemented
method comprising the acts of:

providing a plurality of synchronized agent registries each declaring a set of
functional capabilities for one or more of the autonomous electronic
agents, each of the synchronized agent registries being resident within
a separate computer process;

receiving a service request adhering to the ICL;

determining one or more sub-goal requests in order to perform the service
request;

determining a delegation plan that assigns the sub-goal requests to one or
more of the autonomous electronic agents, based upon the
capabilities declared in one or more of the agent registries; ~~and~~

<u>wherein the delegation plan plan includes:</u>

<u>using reasoning that includes one or more of domain-independent</u>
<u>coordination strategies, domain-specific reasoning, and application-</u>
<u>specific reasoning comprising rules and learning algorithms; and</u>

implementing the delegation plan.

55. A computer implemented method as recited in claim 54 wherein the act of
providing a plurality of agent registries further includes replicating at least a

portion of one or more of the synchronized agent registries across a plurality of separate computer processes.

56. A computer implemented method as recited in claim 54 wherein the act of implementing the delegation plan is controlled by a computer process separate from the computer processes wherein the plurality of synchronized agent registries reside.